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(54) A DISC-LIKE PHONOGRAPH RECORD

(71) We, MATTEL, INC., a Coporation organised and existing under the laws of the State of Delaware, United States of America, of 5150 Rosecrans Avenue, Hawthorne, California, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:

The present invention relates to sound reproducing devices for use in toys or the like and, more particularly, to an improved record for such devices on which are recorded a plurality of sound sequences in congruent spiral sound grooves.

The use of sound reproducing devices in toys, in order to produce talking toys, is well known. Typically, such a sound reproducing device, which is concealably mounted in a toy, includes a disc-like record in which a plurality of sayings are recorded in separate, independent sound grooves. Generally, the record has, exposed to a stylus, a side with a plurality of multi-convultion congruent spiral grooves. Each groove extends from an outer convolution at an outer radial distance to an inner convolution at an inner radial distance from the record's center. The device includes a tone arm which supports the stylus, whose function is to produce mechanical signals whenever it is engaged in one of the sound grooves and follows therein as the record turns or rotates in a selected direction, known as the Play direction. The mechanical signals are used in an associated diaphragm to produce audio signals which form the saying recorded in the sound groove which is followed by the stylus. The tone arm is generally biased toward the record, to urge the stylus to engage one of the grooves.

The record is generally supported on a spindle-mounted turn-table. A spring motor, generally in the form of a rewindable spiral spring coupled to the spindle. Manually operable means, such as a drawstring, is connected to the spindle. When the string is drawn or pulled, the spindle turns or rotates in a first direction causing the spring to be wound up. Thus, the string pulling represent a Rewind operation. In most prior art devices, the string is also used during Rewind to move the tone arm from a radially inward position, which the arm assumes at the end of Play of a saying, to a radially outward position, in which the stylus is in a position to engage the outer convolution of a groove which it is to follow during a subsequent Play cycle. This is generally accomplished by passing the string through or under the tone arm, so that when the string is pulled it first biases the arm away from the record, thereby disengaging the stylus from the groove. Then, as string pulling continues, the tone arm swings radially outwardly to the outward position. When the string is released, which represents the start of Play, the string is slack so that the arm is free to assume its biased position towards the record, causing the stylus to engage one of the grooves. Also, as the string is released, the power spring is free to unwind. As it unwinds, it rotates the spindle and the turntable on which the record is mounted, in a second direction, representing the Play direction. It is during the rotation of the record in the Play direction that one of the recorded sound sequences or sayings is reproduced.

In the prior art devices, various teachings are employed in saying selection for reproduction. In some devices, the tone arm's radial position at the start of each Play cycle is controlled to successively engage an outer convolution of a different spiral groove in order to reproduce the sayings in a selected sequence. In other devices, the turntable is indexed, angularly, to position a selected surface portion of the record adjacent the tone arm, which is in a start of Play position, so that as Play starts, the stylus engages the outer convolution of a selected spiral groove which extends into the record's selected surface portion.

In prior art devices of the latter-mentioned type, significant difficulties exist in the proper indexing of the turntable to insure proper selection of the saying to be reproduced. These difficulties are primarily due to the fact that a relatively large number of sound grooves are recorded on a small record. Consequently, the grooves are very close to one another, necessi-

tating a very precise turntable indexing mechanism to ensure that a selected groove is positioned adjacent the stylus for engagement therewith. Such precise mechanisms are usually quite complex and expensive, which are undesirable limitations from toy performance and toy production points of view. Thus, a need exists for a new record which would be indexed by means of a simple mechanism to facilitate the engagement of a stylus with any one of a plurality of spiral sound grooves therein.

According to the invention there is provided a disc-like phonograph record comprising at least one side adapted to be exposed to a stylus, said side forming a first surface portion with independent congruent multi-convolution spiral grooves, each groove having recorded therein a separate sound sequence, said exposed side further forming at least one additional surface portion, said additional surface portion defining a plurality of segments, each segment including a plurality of lead-in grooves all of which are interconnected with a convolution of a respective one of said spiral grooves.

The invention will be described by way of examples with reference to the accompanying drawings, in which :

Figure 1 is a simplified top view of a disc-like phonograph record in accordance with the present invention;

Figure 2 is a simplified top view of another embodiment of the invention; and

Figures 3 and 4 are simplified top views of yet other embodiments of the invention.

Reference is now made to Figure 1 which is a top view of one embodiment of the present invention, designated therein by numeral 10. The record has an "exposed side" 12, which is adapted to be exposed to a stylus 30 and which for explanatory purposes may be thought of as being divided into two main surface parts. One part is an inner annular surface 14, surrounded by an outer ring-like annular surface 16, which in Figure 1, is shown divided into six part-annular segments designated S1-S6.

As in some conventional or prior art records, for use in sound reproducing devices in toys, the inner annular surface 14 has formed therein, or defines a plurality of congruent spiral sound grooves. In the embodiment in which the annular surface 16 includes only six segments, only six spiral sound grooves are defined in surface 14. These are designated by G1-G6. Each of the spiral grooves may be thought of as including an outer convolution adjacent to the outer periphery of the annular surface 14 and an inner convolution disposed towards the center 20 of record 10. Preferably, all the inner convolutions of the spiral grooves may terminate in a common inner convolution 22. As in the prior art, the function of each spiral sound groove is to have recorded therein a different saying or sound sequence.

Forming part of the sound reproducing device in which record 10 is assumed to be incorporated, is a tone arm 24, pivotally mounted about a pivot 25. The arm supports the stylus 30. As is appreciated by those familiar with the art, as the record 10 rotates in a Play direction, such as represented in Figure 1 by arrow 32, the function of the stylus 30 is to engage one of the spiral sound grooves and follow therein to produce mechanical signals which are then used, in appropriate sound reproducing means, to produce audio signals representing the saying recorded in the groove.

As previously pointed out, one of the major problems of prior art devices is the accurate positioning of the stylus with respect to a selected portion of the surface of side 12 in order to select the proper spiral groove that the stylus engages in order to produce a selected saying. In the prior art, the turntable has to be very accurately indexed and precautions must be taken to ensure that either before Play starts, or immediately as soon as Play is initiated, the stylus 30 engages the selected spiral groove. These precise requirements complicate the sound reproducing device and often result in malfunctioning or improper performance.

Such limitations, however, are overcome by the novel record of the present invention in which the various part-annular segments (S1-S6) are used to define lead-in grooves. The grooves in each segment are in communication with the outer convolution of a different one of the spiral sound grooves. As a result, the indexing accuracy that is required is only that needed to ensure that any one of the lead-in grooves in a sector which is in communication with a selected spiral groove is engageable by the stylus 30 at the start of Play to properly lead the stylus 30 into the desired outer convolution of the selected spiral groove.

For example, when utilizing record 10 if the saying, recorded in the spiral groove G1 is selected for reproduction, it is only necessary to index the record 10 with respect to the stylus 30 to ensure that any one of the lead-in grooves in segment S1 is engageable thereby. Since all the lead-in grooves in sector S1 are in communication with the outer convolution of G1, when the record 10 is rotated in the Play direction (arrow 32) the stylus will be properly lead into the outer convolution of spiral groove G1, as long as one of the lead-in grooves in segment S1 is engaged by the stylus 30.

As shown in Figure 1, each part-annular segment defines a main arcuate lead-in groove 34, which is adjacent the inner arcuate boundary of the sector. Groove 34 extends in a direction, which forms a smooth continuation of the outer convolution of the groove with which it is in communication. Each segment further defines two outwardly directed lead-in grooves 35 and 36, which for explanatory purposes may be assumed to lie adjacent the segment's radial boundaries. Each of the outwardly

directed lead-in grooves is in communication with the arcuate lead-in groove 34 of the segment.

From the foregoing description, and Figure 1, it should be apparent to those familar with the art, that as long as the record 10 is indexed so that the stylus is capable of engaging any of the grooves in the record surface, bounded by grooves 34, 35 and 36, of any selected segment, as the record starts turning in the Play direction, the stylus would engage one of the lead-in grooves in the segment and would eventually be lead into the outer convolution of the spiral groove associated with said segment. In Figure 1, stylus 30 is shown engaged in lead-in groove 36 of S1. In such a situation, as record 10 starts rotating in the Play direction, the stylus would follow lead-in groove 36 into the arcuate lead-in groove 34 and therethrough into the outer convolution of spiral groove G1.

The stylus would be similarly lead into the proper spiral groove G1, even if it were not directly engaged in any of the lead-in grooves. For example, assuming that as a result of record indexing, the stylus engages a portion of the surface in segment S1 between grooves 35 and 36. As the record is rotated in the Play direction, lead-in groove 35 will eventually pass under and engage stylus 30. Then, as the record will continue to rotate lead-in groove 35 will serve to lead the stylus into the arcuate lead-in groove 34 adjacent the point at which the latter is in communication with the outer convolution of the spiral groove G1.

Summarizing the foregoing description, in accordance with the teachings of the present invention, a record is provided having an annular surface, which defines the congruate spiral sound grooves, each one of which is in communication with a plurality of lead-in grooves in a different segment of a ring-like annular surface, surrounding the annular surface in which the spiral sound grooves are defined. The lead-in grooves in each segment include a main arcuate lead-in groove, as well as two outwardly directed lead-in grooves, adjacent the opposite radial boundaries of the segment.

The number of outwardly directed lead-in grooves need not be limited to the two adjacent the opposite radial segment boundaries. Rather, the surface between the two outwardly directed lead-in grooves, 35 and 36 in each segment, may be used to define a plurality of outwardly directed lead-in grooves, substantially congruent to grooves 35 and 36. Such additional grooves are designated in segment S4 by numerals 41-45. It is apparent that by increasing the number of radial lead-in grooves, in each segment, all of which are in communication with the segment's arcuate lead-in groove 34, which is in turn in communication with the outer convolution of one of the spiral grooves, the added grooves greatly increase the probability that the stylus will be properly lead into the appropriate outer convolution of the desired spiral groove. Also a high density of lead-in grooves minimizes the angular displacement required of the record to cause the stylus to be engaged by a groove. This early engagement reduces the velocity and impact of the stylus entering the groove if the stylus was engaged with the record at a point between lead-in grooves prior to record rotation. In the case where the stylus is dropped onto or otherwise is cause to engage a record already in motion the probability of groove damage is high, however, the multiplicity of grooves extend the record life.

In addition to providing the added outwardly directed lead-in grooves, the record 10 may further define an outer, continuous circular groove 50, which is shown extending through all the segments. Such a groove may find utility in sound reproducing devices in which the tone arm 24 is positioned during Rewind at a fixed position, such as the one shown in the dashed line in Figure 1, and the stylus 30 is permitted to engage the surface 12 of record 10 before the record has been completely indexed. In such a device, in the absence of groove 50, a noticeable and perhaps objectionable noise is produced once the stylus is in engagement with the surface 12 of the record 10 while the latter is still being rotated in the Rewind direction (arrow 52) to its proper indexed position. The noise is generated by the successive engagement and disengagement of the stylus 30 with the successive lead-in grooves with which it may come in contact. However, by providing groove 50 the stylus 30 engages groove 50 during Rewind until the record is properly indexed. Thereby eliminating the generation of objectionable noise.

In such an arrangement, the tone arm has to be properly biased in an inward direction. This is necessary to ensure that once Play begins even though the stylus is in the circular groove 50 it is lead into one of the outwardly directed lead-in grooves which intersect groove 50 in the part-annular segment, indexed adjacent the stylus for proper saying reproduction. Assuming, for example, that the record is indexed so that S4 is adjacent the tone arm with the stylus 30 in groove 50 between lead-in grooves 42 and 43, the arm 24 need be biased inward to ensure that as Play starts, the stylus is urged to follow one of lead-in grooves 42, 41 and 35 in S4, preferably groove 42. Bias may be provided by springs, gravity or other means or by the unique choice of tone arm length and the tone arm pivot location with respect to the center of rotation of the record so as to produce an inward, component of force on the stylus resulting from the friction force created by its scuffing on the record face, independent grooves. It should be appreciated by those familiar with the art that the larger the annular segment,

and the larger the number of lead-in grooves defined therein, the greater the likelihood that the proper spiral groove is engaged for proper saying reproduction, even under relatively poor record indexing accuracy. Thus, in order to retain the advantages of the present invention, it is important that the segment not be too small. In order to ensure proper minimum segment size, when the number of congruent spiral sound grooves which have to be defined on a single record is relatively large, in accordance with the teachings of the present invention instead of dividing a single ring-like annular surface such as the one shown in Figure 1, into small segments, the record may be formed to define a plurality of concentric ring-like annular surfaces, surrounding the inner circular surface which defines the spiral grooves with each annular surface divided into sufficiently large part-annular segments. A record with two concentric ring-like annular surfaces is shown in Figure 2, wherein elements like those previously explained, are designated by like numerals. Therein, two concentric ring-like annular surfaces are designated by numerals 16*a* and 16*b*, each comprising six segments S1 through S6. Thus, a relatively long annular segment is provided to define the lead-in grooves for each of the spiral grooves.

It should be appreciated that when utilizing a record with a plurality of ring-like annular surfaces, the saying selection involves both indexing of the record, as well as controlling the pivotal position of the tone arm. The tone arm position controls the annular surface with respect to which the stylus is positioned, thereby selecting the annular surface, while the record indexing selects the particular part-annular segment.

Accordingly, in accordance with the teachings of the present invention, different embodiments of a record, defining a plurality of congruent spiral sound grooves are provided. A part-annular segment is provided for each of the spiral sound grooves, to define a plurality of lead-in grooves, whcih are in communication with the spiral groove's outer convolution. By such an arrangement, the proper spiral groove is engaged by a stylus of a tone arm associated with the record as long as the segment associated with the groove is properly indexed with respect to the stylus prior to the start of Play cycle, or saying reproduction.

In the foregoing description various embodiments of the invention have been described, all of which include one or more ring-like annular surfaces surrounding the center portion of the record surface (designated 14 in FIGURE 1) in which the congruent spiral grooves are defined. It should be pointed out that the invention is not limited to such embodiments. If desired, the lead-in grooves may be defined in surface segments located close to the record's center, with the lead-in grooves in each segement in communication with a different spiral groove. Clearly, in such an embodiment, record rotation during Play would be in a direction opposite that shown in FIGURE 1, ie, counterclockwise.

Reference is made to FIGURE 3 which is a simplified top view of such an embodiment, wherein elements like those previously dscribed are designated by like numerals. In FIGURE 3 spiral groove G2 is fully diagrammed from a start point 61, adjacent its arcuate lead-in groove 34 with which all its lead-in grooves 35, 36 and 41-45 are in communication, to an end point 62. For explanatory purposes, several lead-in grooves for each of grooves G1 and G3 in either side of groove G2 are also diagrammed together with the start and end points 61 and 62 of these two grooves.

From the foregoing it should be appreciated by those familiar with the art that if desired, lead-in grooves may be defined in surface segments both near the record periphery as well as near its center. One such embodiment is diagrammed in the simplified partial top view of a record shown in FIGURE 4 to which reference is made herein. As diagrammed, the lead-in grooves of odd numbered grooves, such as G1, G3, etc., are located at surface segments near the record's periphery while the lead-in grooves of even-numbered spiral grooves are located as surface segments near the center of the record. In such an arrangement each odd-numbered groove (such as G3) terminates between surface segments containing the lead-in grooves of the two even-numbered grooves in opposite sides thereof (such as G2 and G4) while each even numbered groove (such as G4) terminates near the record's periphery between surface segments containing the lead-in grooves of adjacent odd-numbered grooves (such as G3 and G5). Clearly, however, this is only one arrangement and that if desired, other arrangements may be employed. For example, the spiral grooves may be divided into groups with all the spiral grooves in each group having their lead-in grooves located near the record's center or its periphery. It should be pointed out, however, that the sound sequences in all the spiral grooves having their lead-in grooves near the record's periphery are reproduced when the record turns during Play in the same direction such as clockwise for the diagrammed record. Opposite record rotation is required to reproduce the sayings in the spiral grooves whose lead-in grooves are near the records center.

It should be appreciated that those familiar with the art may make modifications and/or substitute equivalents to the arrangements hereinbefore described, without departing from the scope of the invention. For example, the ends of all spiral grooves may not necessarily terminate in a common groove 22 as shown

in FIGURE 1. If desired, selected grooves forming separate groups may terminate in separate confluences.

Although particular embodiments of the invention have been described and illustrated herein, it is recognized that modifications and variations may readily occur to those skilled in the art.

WHAT WE CLAIM IS:

1. A disc-like phonograph record comprising at least one side adapted to be exposed to a stylus, said side forming a first surface portion with independent congruent multi-convolution spiral grooves, each groove having recorded therein a separate sound sequence, said exposed side further forming at least one additional surface portion, said additional surface portion defining a plurality of segments, each segment including a plurality of lead-in grooves all of which are interconnected with a convolution of respective one of said spiral grooves.

2. A record as claimed in Claim 1 wherein said first surface portion defines an inner annular surface about a center of said record, each sound sequence starts at a start point which is at a grooove section adjacent the periphery of said inner annular surface and each sound sequence ends at an end point which is at a groove position located at a selected radial distance from said center, said at least one additional surface portion defines a ring-like annular surface extending from the periphery of said inner annular surface toward the record periphery, and each of said segments define a part-annular portion of said annular surface.

3. A record as claimed in Claim 2 wherein each part-annular has first and second radial boundaries, inner and outer arcuate boundaries extending between said first and second radial boundaries, and said plurality of lead-in grooves includes: at least a first arcuate lead-in groove adjacent said inner arcuate boundary, first and second outwardly directed lead-in grooves adjacent said first and second radial boundaries respectively, extending outwardly from said first arcuate lead-in groove, and in communication with the outer convolution of one of said spiral grooves through said first arcuate lead-in groove.

4. A record as claimed in Claim 3 wherein each part-annular portion further defines at least one additional lead-in groove in communication with said first arcuate lead-in groove, disposed between said first and second outwardly directed lead-in grooves.

5. A record as claimed in Claim 2 wherein said record exposed surface further defines a first continuous circular groove in said annular surface which passes through all the part-annular portions and is in communication with all the lead-in grooves therein.

6. A record as claimed in Claim 2, 3, 4 or 5 in combination with a sound-reproducing apparatus comprising said stylus and means for indexing said record with respect to any one of a plurality of positions of said stylus at the start of a Play cycle, each of said stylus positions being radially displaced a pre-determined distance from a first stylus position.

7. A record as claimed in Claim 6 including a plurality of said ring-like annular surfaces concentrically disposed and serially extending from said periphery of the inner circular surface to the record's periphery, each annular surface defining a separate plurality of part-annular segments, each segment having formed therein a plurality of lead-in grooves including a main lead-in groove for connecting all the segment's lead-in grooves to the outer convolution of one of said spiral grooves, each of said ring-like annular surfaces being associated with a corresponding one of said stylus positions.

8. A record as claimed in Claim 1 wherein said first surface portion extends from a first radial distance from a center of said record towards the periphery of the record, and said additional surface extends from said first radial distance towards the record center, whereby at least a portion of said spiral grooves are in communication with lead-in grooves located in said additional surface.

9. A record as claimed in Claim 8 wherein each segment defines an arcuate lead-in groove in communication with an inner convolution of a different spiral groove, and each segment further defines third and fourth outwardly directed lead-in grooves which are in communication with the arcuate lead-in groove of the segments said third and fourth lead-in grooves being disposed adjacent opposite radial boundaries of said segments.

10. A record as claimed in Claim 9 wherein each segment further defines at least one additional lead-in groove in communication with said arcuate lead-in groove congruently disposed between said third and fourth lead-in grooves.

11. A record as claimed in Claim 1 wherein said first surface portion extends from a first radial distance r_1 from the center of said record to a second and greater radial distance r_2 from the center of said record, said record further including at least one additional multi-segment surface portion extending from said radial distance r_2 towards the record's periphery and at least one further additional multi-segment surface portion extending from said radial distance r_1, towards the record's center, each segment defining lead-in grooves in communication with a spiral groove in said first surface portion.

12. A record as claimed in Claim 1 wherein said plurality of segments are of equal size.

13. A disc-like phonograph record substantially as described with reference to Figure 1 of the accompanying drawings.

14. A disc-like phonograph record substantially as described with reference to Figure 2 of the accompanying drawings.

15. A disc-like phonograph record substantially as described with reference to Figure 3 of the accompanying drawings.

16. A disc-like record substantially as described with reference to Figure 4 of the accompanying drawings.

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1258022 COMPLETE SPECIFICATION

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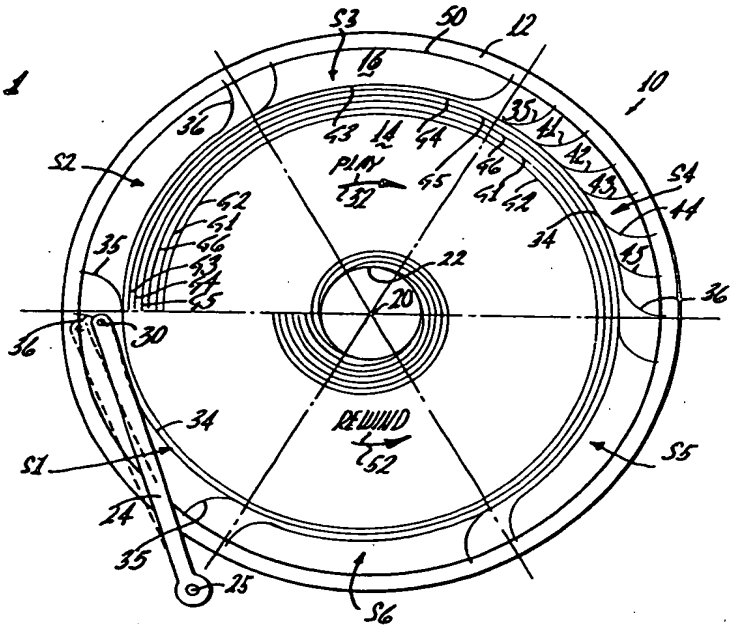
Sheet 1

FIG. 1



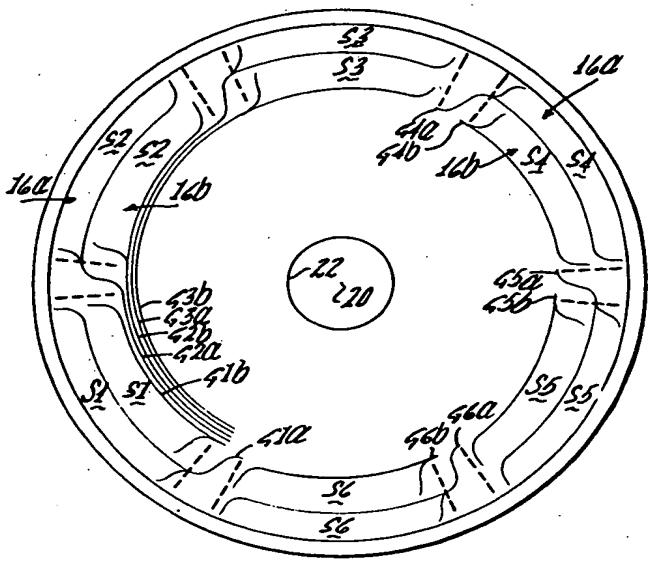
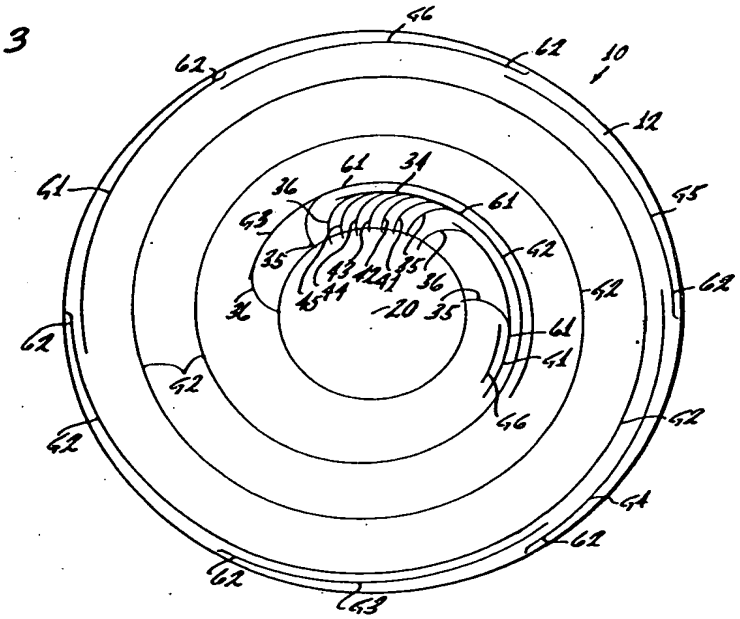


FIG 2

1258022 COMPLETE SPECIFICATION
2 SHEETS This drawing is a reproduction of the Original on a reduced scale
Sheet 2

Fig.3



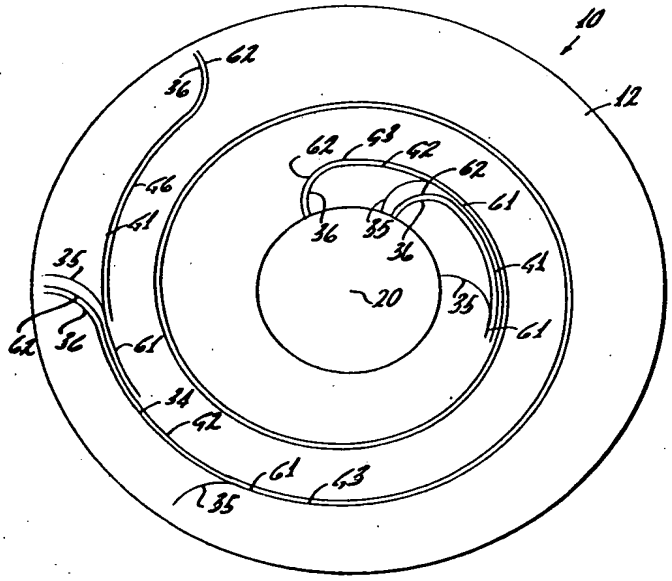


Fig.4